

M4D

REPORT ON THE MOBILES FOR DEVELOPMENT (M4D) COURSE

For six weeks beginning October 2, 2013, IIT Kanpur and Commonwealth of Learning delivered a massive open online course (MOOC) on mobiles for development (M4D). This report provides a pedagogical review of the M4D online course. A review of the M4D course design and delivery experience will help COL staff to better understand the prototype course, its participants, their performance and their response to the course design.

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Executive summary

For six weeks beginning October 2, 2013, IIT Kanpur and Commonwealth of Learning (COL) delivered a massive open online course (MOOC) on the topic of mobiles for development (M4D). This report provides a pedagogical review of the M4D online course to assist IIT and COL staff to better understand the outcomes of the prototype course, the participants, their participation and performance, and their response to the course design.

KEY FINDINGS

Relevance

The IIT and Col M4D team demonstrated that successfully offering large online courses did not have to use custom and “branded” MOOC platforms of the type used by well-known MOOC providers such as *Coursera* and *Udacity*. The open source software platform *Sakai* was used successfully to provide a MOOC-style course to 1,441 course participants.

Successes and impacts

The course attracted 2,282 registrants from 116 countries. About 63 percent of the registrants were considered to be “active” in the course space (1,441 students).

A total of 333 students were eligible to receive certificates of Competence (244 students) or Participation (89 students). Certificates (P or C) were awarded to approximately 23 percent of active participants in the M4D course.

The top five countries in terms of registrants were India, Nepal, Mauritius, Grenada and South Africa. About 500 registrants were from countries in the Africa, Caribbean, and Pacific regions. About 200 registrants were from the OECD countries, and from Eastern Europe.

Design and delivery

The team demonstrated that teaching quality and content were critical factors in keeping participants interested. The team also demonstrated that high availability of online services is a critical factor to keep students as participants in a MOOC.

Online mentoring /facilitation was a key investment of time for which instructors should be trained and prepared. ODL institutions may have a significant starting advantage in offering MOOCs because of their inherent strengths with pedagogy, resources and expertise to mount large-scale learning programs.

Cost-effectiveness

The M4D online course demonstrated that a low-cost, open source software delivery platform combined with open educational resources (OER) could be used effectively to provide a hybrid MOOC environment that served over 1,400 learners.

Introduction

BACKGROUND TO THE REPORT

The concept of massive open online courses (MOOCs) has been hailed as both a disruptive change in higher education practice and an opportunity to provide the under-served with free access to university level courses. Making post-secondary educational experiences available at scale has been promoted as a opportunity for anyone with Internet access who is motivated to invest time in learning activities delivered in short video segments supplemented with online tutorials and assessed using automated online self-evaluation exercises and summative quizzes and tests. Khan Academy (2014) has popularized the format in K-12 education, while universities such as MIT and Stanford have demonstrated similar approaches for a higher education audience.

Many MOOCs share a common goal of bringing large numbers of learners together (generally 1,000 students or greater) in a common environment for a course delivered as a set of online lessons. However MOOCs are not all presented in the same manner and often differ in terms of their primary strategy for learning design. Some MOOCs use a traditional lecture format that substitutes video lectures for the face-to-face lecture component of a course and provide automated exercises and quizzes along with opportunities to interact among fellow students, and with the course instructors, using discussion boards or chat functions. This style of MOOC is often referred to as an xMOOC, and is characterized by the offerings from MOOC providers such as *Coursera* and *Udacity* and their university partners. These MOOCs tend to use custom-designed technical platforms, scheduled learning events, and proprietary learning resources.

Another model of design is referenced as a cMOOC, and these systems use constructivist or connectivist pedagogies (Siemens, 2008) wherein learners are encouraged to build their own knowledge through social learning processes within flexible timeframes, guided by course instructors, and often using open educational resources (OER). It has been argued that the pedagogy of xMOOCs is better suited for learning domain knowledge that can be mastered through repetitive practice, and that cMOOCs may be better suited for allowing learners to acquire higher order creative skills (Bates, 2012b). The cMOOC concept was derived from course experiments led in 2008 by Canadian educational researchers, George Siemens (2008) and Stephen Downes (2006) that generated discussions about the pedagogical theory of connectivism, that proposed learning as a creative and social process of connecting nodes of knowledge.

There are also hybrid design models such as those used by MIT and Harvard that use the *edX* open source technical platform. *edX* combines many of the key features of an xMOOC course delivery format and also uses open educational resources (OER). M4D was primarily a hybrid MOOC, similar to *edX*-based MOOCs.

This report provides a pedagogical review of the Mobiles for Development (M4D) online course that was conducted over six weeks beginning October 2, 2013 by IIT Kanpur and Commonwealth of Learning. It is intended that the review of the M4D course design and delivery experiences will help COL staff to better understand the prototype course, its participants, their performance, and their responses to the course design.

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CONTEXT FOR THE M4D COURSE

Currently, the use of MOOCs is being tested in the context of expanding capacity to meet the growing demand for educational and learning content and services worldwide. Many of the world's leading higher education institutions are attempting to provide access to high quality education for people around the world, including the disadvantaged and under-served. In this context, and drawing upon its experience in offering online courses on large scale, and its interest in fostering new perspectives on MOOCs in the context of learning for development, the Commonwealth of Learning collaborated with the Indian Institute of Technology Kanpur (IITK) to offer a six-week MOOC starting October 2, 2013.

THE M4D COURSE DESIGN

The topic of the M4D course was Mobiles for Development (M4D). Mobile devices have spread on a very large scale in developing countries and they have widespread presence, even in remote areas and among people with little or no history of using information and communications technologies (ICT), or telecommunications services provided through mobile phones or tablet devices.

Course goals

A primary goal for the M4D course was to determine how best to use MOOCs to serve the development needs of resource-poor communities of learners — those at the "bottom of the pyramid" (Prahalad & Hart, 2002).

To do so, the team conducted the M4D course with a view to better understanding the dynamics surrounding the design, delivery and support issues in delivering the MOOC-style courses in order to develop solutions and action plans that would support its primary goal for the course and lead to improvements in practice in subsequent iterations.

Course team

The course team included instructors, resource persons and mentors, and technical staff. Instructors, teachers and mentors were from IIT-Kanpur, IIT-Ropar, COL, Athabasca University, and the National Institute of Bank Management (India).

The following were the M4D MOOC design team members.

- Professor T.V. Prabhakar, Department of Computer Science and Engineering (IIT-Kanpur) was the principal instructor of the course.
- Other members on Professor Prabhakar's team included:
 - Dr. Balwinder Sodhi (IIT-Ropar) and Dr. Ashish Agarwal (IIT-Kanpur).
 - Dr. V. Balaji, Dr. K. Balasubramanian and Dr. A. Umar from COL served as resource persons and were supported by Mr. Ricky Cheng, a specialist in cloud services.

Guest resource persons were featured in video-based case studies of practice from multiple regions of the world.

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Some of the instructors gave time to support learner-mentor interactions in the online chat room and discussion forums. Four real-time chat sessions were organized to enable learners to chat (in text) with the instructors online and 18 time zones were covered during the chat sessions.

COURSE AIMS AND OBJECTIVES

The course instructors provided a clear set of aims and objectives for the course when it was first advertised to students through the Commonwealth of Learning, and using social media promotional techniques in networks that would attract participation in the developing world.

The following seven text sections outline the course aims **as stated by the course development team** (Commonwealth of Learning, 2013a) **and are directly cited from the website**, Mobiles for Development: Massive Open Online Course (MOOC) and retrieved from <http://m4d.colfinder.org>.

About

Mobile devices, phones as well as tablet computers have been spreading fast across the globe. The spread of mobile phones in developing countries has been increased dramatically. More people have access to cell phones today than to clean water.

Mobile communication and computing technologies have much potential to contribute to human development. This is already felt in some measure in learning. There are reports of new advantages and benefits in other sectors such as agriculture and food production, and rural credit and finance. This course is about important concepts and practices in mobile technologies that are relevant to learning and education, agricultural extension and rural credit and finance.

Outcome for Learners

At the end of the course, learners will be able to recognize frequently used terminology, and identify techniques and methods in mobile computing and communications that are relevant to development. Learners will also be able to recount key use cases and successes, and recognize common policy requirements for the support of mobiles for development. This course is taught in English.

Who Should Attend This Course

This course would be of particular benefit to:

- Teacher educators
- Administrators in ODL organizations
- Banking personnel in loan appraisal, and rural and agricultural credit
- Managers of micro-finance organizations and community banks
- Agricultural extension personnel in public and private sector
- Civil servants with interest in e-Governance
- Mobile tech developers
- Students in ICT for development courses

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Learner certification

The Indian Institute of Technology Kanpur and Commonwealth of Learning (COL) will jointly issue certificates of participation to learners upon successful completion of the course.

Requirements for participation

This course is open and free to any learner. There are no pre-requisites. Any interested individual may register and participate.

Commitment and support

The expected commitment of learners is 4 hours/week on average. Instructors and mentors will be available online through the duration of the course to discuss topics and issues.

Institutions

The Indian Institute of Technology Kanpur is a premier research university that is pioneering a number of advances in mobile technologies and their applications. Notable developments in this area include the vKVK, a platform that connects KVKs with farmers through Internet and mobile technology, and the Digital Mandi initiative linking farmers and markets. IITK is also a pioneer in offering MOOCs.

Commonwealth of Learning, an inter-governmental organization in the Commonwealth family, is globally known for its efforts and advocacy to improve access to learning at all levels. COL and partners in sub-Saharan Africa and South Asia have been making use of mobile technologies to help disadvantaged communities access learning and credit services.

COURSE TOPICS

The focus of the M4D MOOC was on helping learners increase their awareness of important developments in technology, essential terminologies, and the critical processes for engaging and working with stakeholders in this sector.

Topics covered in M4D MOOC were:

- The extent of the use of mobile technologies in a development context.
- Terminology, techniques and methods in mobile computing and communications applied to development.
- Information and case studies on mobile devices and technologies in education, rural banking and finance and agricultural extension using cases from multiple regions of the world.
- Specific case studies where mobile computing and communication technology have been applied with some success in education, rural banking and agricultural extension.
- Policies to support the use of mobile technologies for development.

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Course structure and technical requirements for participation

The course was structured around core topics and specialized modules related to human development.

Learners were encouraged to complete all topics and modules, with the expectation that a motivated learner would spend about four hours on average per week. Instructors and mentors were available throughout the course to discuss topics and issues online in both discussion forums and chat spaces.

As a MOOC-style course, there were no pre-requisites and access to the Internet was a requirement. Interested individuals could sign up for the course and learn any or all the topics, using desktop PC or laptop. Tablet and smartphone access was required, using devices running Android 2.2 and above, to participate in the M4D course.

Course delivery platform

The IITK team identified *Sakai*, an open source learning managements system (LMS) as the most suitable platform for use as an online classroom in the M4D course. *Sakai* was also mobile-enabled which provided additional flexibility and relevance to the topic, enabling interested learners to use tablets or smartphones to participate fully in the course.

Course materials and resources

All the learning materials were delivered as YouTube videos, and no video was longer than 25 minutes.

PowerPoint slides were used and scripts for many of the videos were made available as PDF documents. All these materials were released as OER. The team considered the provision of these materials for download to be consistent with the M4D team's advocacy of OER for development. At the time of this report, the M4D course was also one of a minority of MOOCs to make content available as OER.

Assessment

Two quizzes were provided, one at the end of main technology topics, and another towards the close of the course.

Approach to the design review

Commonwealth of Learning staff requested an external review of the M4D MOOC.

This review of the M4D course design and delivery experience was designed help COL staff to better understand the prototype course, its participants, their performance and their response to the course design.

The following aspects were reviewed and reported and discussed in this report.

- Course aims and objectives
- Course design, resources, activities and evaluation strategies (pedagogical elements)
- Course technical platform
- Course results
- Course cost analysis in relation to potential and/or actual outputs/outcomes, and as compared to available benchmark figures for similar online courses (assuming cost figures that represent total cost of operations could be obtained conveniently from IIT Kanpur and COL)
- Feedback from students, specifically a high-level thematic analysis of student comments, coded for anonymity
- Feedback from instructors and staff through responses to written questions, with the assurance of anonymity for all respondents through the use of response coding

REVIEW PROCESS

The review of the course used the M4D websites, documents, questionnaire data, and existing literature.

File and document review

All documents and files for the M4D course were available online for review, primarily from public websites, but in the case of the course itself, an archive was used for retrospective review.

Websites, files and documents reviewed were obtained from the following primary sources:

- Commonwealth of Learning: MOOC for Development (MOOC4D)
<http://www.col.org/progServ/programmes/KM/Pages/MOOC4D.aspx>
- Commonwealth of Learning: MOOC on Mobiles for Development
<http://www.col.org/progServ/programmes/KM/Pages/MOOCM4D.aspx>
- Facebook: MOOC on Mobile for Development
<http://www.facebook.com/events/141746969368053/>
- Mobiles for Development: Massive Open Online Course (MOOC) by IIT Kanpur and COL
<http://m4d.colfinder.org>
- Mobiles for Development: Massive Open Online Course (MOOC) by IIT Kanpur and COL
<http://www.m4d-mooc.org> through an unpublished archive to M4D course site

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Questionnaires

In addition, two surveys (questionnaires) and their results were reviewed. They were:

- Questionnaire responses from 208 students who participated in the M4D MOOC
- Questionnaire responses from 5 members of the M4D MOOC development team

The student survey collected responses voluntarily and anonymously from students at the conclusion of the M4D course. The responses were collected online and exported to an Excel spreadsheet format for review and analysis. The data are presented and discussed in the Findings section of this report, which follows.

Questionnaire responses from development team members were collected in March 2014, four months after the conclusion of the M4D course. The questionnaire was conducted voluntarily and anonymously online, using *FluidSurveys.ca*. The data are presented and discussed in the section of this report on Findings.

Literature

Current academic literature concerning the design and delivery of MOOCs was consulted and referenced as appropriate within the report.

Literature on online course design, delivery and evaluation was also consulted and referenced as appropriate in the body of the report.

LIMITATIONS

Retrospective review of the M4D course

The reviewer did not participate in the M4D MOOC during its delivery timeframe in October and November 2013. As a consequence this review is retrospective, using available documents and course archives. No sense of the rhythm or ethos of the M4D course during its delivery timeframe was possible.

Student questionnaire

208 students provided responses to the voluntary questionnaire. The response rate can be calculated as a percentage of active participants who visited the M4D web site. Active participants numbered 1,441.

- Active participant questionnaire response rate was $208 / 1,441 = 14$ percent

Instructor questionnaire

Seven members of the design team were sampled using a questionnaire that asked questions about the learning design intent for the course from their personal perspectives.

- Response rate from the design team sample was $5 / 7 = 71$ percent

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Review findings

FRAMEWORKS FOR ANALYSIS

Bates and Poole (2003) provide useful frameworks for evaluating effective teaching with technology in higher education. In particular Bates used the acronym SECTIONS to describe one specific model that is useful in the context of the M4D course review. It is described in the table below.

SECTIONS FRAMEWORK (BATES & POOLE, 2003)

SECTIONS THEME	ATTRIBUTES
Students	Student demographics, needs, situation
Ease of use or access	Ease of use and reliability,
Cost	Cost considerations for students and institution
Teaching functions	Instructor's approach to Teaching and learning
Interaction	Desired level of Interaction for students
Organization	Organizational support needed
Novelty	Novelty factor
Speed	Speed with which the technology can be adopted or implemented

Bates has updated his framework over the past few years to account for new technologies and models of practice, such as MOOCs. Currently he is discussing a more refined schema in his presentations and blog posts, and according to Bates (2014a) the new schema (PSLR) will be useful for “deciding where in the continuum of online learning a course or program should be, but it doesn’t have a catchy acronym.”

This updated schema asks four questions that educators and instructional developers should consider prior to designing a new course or program (Bates, 2014a):

- Pedagogy: How would you really like to teach (e.g. information transmission; experiential; inquiry-based; knowledge management)?
- Students: What kind, what age, ability to learn independently; experience in the subject area?
- Desired learning outcomes (skills and content) to decide what is best done online – or the requirements of the subject discipline?
- Resources: What instructional design and technology support is available?

The PSLR framework and elements of the SECTIONS framework were used in reviewing the pedagogical and technical approaches used by the M4D team. In particular, the PSLR framework was used to develop questions requiring a text-based response from the M4D development team in the March 2014 online questionnaire.

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COURSE DESIGN

The M4D course was delivered using the *Sakai* open source technical platform. The screen layout for the course was designed for straightforward navigation to all components of the course. The features of the M4D course are numbered in the screen capture below, and are described in the legend below the screen capture.

The screenshot shows the Sakai MOOC M4D - Autumn2013 Course Lectures page. The page layout includes a top header with the Sakai logo, a navigation menu on the left, and a main content area displaying a table of course lectures. The table is organized by week and topic, with color-coded rows for each topic. The following table represents the data shown in the screenshot:

Topic	Category	Speaker(s)	Lecture Video	Script/Slides
Week0				
Course Introduction (short)		Prof. TV Prabhakar	View	
Course Introduction (long)		Prof. TV Prabhakar Mr. Ashish Agrawal	View	
MooC Support: Navigation on the course site		Ms. Michelle Gruda	View	
MooC Support: Managing profile on the course site		Ms. Michelle Gruda	View	
Week1 : Wednesday 2 October 2013				
Introduction to Week1	Core	Prof. TV Prabhakar	View	
Mobiles for Development - the context	Core	Dr. V Balaji	View	Slides , Script
Architecting for Mobiles	Core	Prof. TV Prabhakar	View	Slides , Script
Overview Mobile Learning	Core	Prof. Mohamed Ally	View	Slides , Script
Overview Mobile Banking	Core	Dr. K Balasubramanian	View	Slides , Script
Mobiles in Agriculture - an Example	Core	Ms. Meeta Bagga	View	Slides
Tablet-Phablet	Core	Prof. TV Prabhakar	View	Slides
Introduction to Android	Core	Mr. Ashish Agrawal	View	Slides
Mobile Hardware: Anatomy of a Handset	Core	Prof. Mainak Chaudhuri	View	Slides
Week2 : Wednesday 9 October 2013				
Introduction to Week2	Core	Prof. TV Prabhakar	View	
Mobile Ecosystem - Challenges and Opportunities	Core	Prof. TV Prabhakar	View	Slides
Introduction to Mobile Learning	Core	Dr. Abdurrahman Umar	View	Slides , Script
Mobile Learning, Policies and Technologies	Core	Prof. Mohamed Ally	View	Slides

Copyright 2013 IIT Kanpur MooC on M4D - TRUNK - Sakai 2.9.3 (Kamel 1.3.3)- Server m4dmooc

Features of the M4D *Sakai* course environment:

- | | |
|---------------------------------------|---------------------------------|
| 1 Course header and student workspace | 6 Login and course role graphic |
| 2 Navigation menu for the course | 7 Color-coded legend for topic |
| 3 Topic list | 8 Instructor for topic |
| 4 Weekly module dividers | 9 Video link for topic |
| 5 Colour-coded topics | 10 Slides and/or script link/s |

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COURSE STRUCTURE

Resources

Resources were comprised of the following media types:

- YouTube videos of lesson topics and case studies
- Scripts to accompany many of the video lesson topics
- PowerPoint slides to supplement lessons

The screenshot shows the Sakai MOOC M4D - Autumn2013 Course Lectures page. The main content area displays a video of Prof. Mohamed Ally, a Professor at Alhambra University, presenting on 'Overview Mobile Learning'. Below the video, the speaker is identified as Prof. Mohamed Ally, and resources for the lecture are listed as 'Slides' and 'Script'. The page includes a sidebar with navigation links such as Home, Course Lectures, Announcements, Chat Room, Forums, Tests & Quizzes, Markbook, Resources, Site Info, Statistics, Schedule, and Help. The footer contains copyright information: Copyright 2013 IIT Kanpur MooC on M4D - TRUNK - Sakai 2.9.3 (Kernel 1.3.3) - Server m4dmooC.

The primary instructional strategy for the M4D course was the use of instructional videos that varied in length from 2 – 25 minutes.

In total there were 92 videos produced by the development team for the topics for the course. The videos were organized over a six-week time period. Students were required to view 15 videos per week on average.

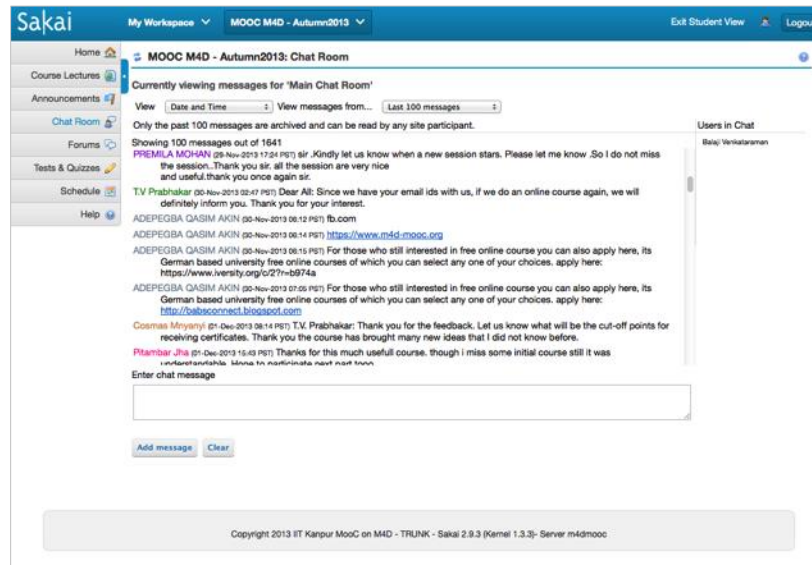
Most video lectures also included a supplementary PowerPoint slide deck. In some cases, a script was also produced to accompany video, and student feedback indicated that scripts were helpful in dealing with unfamiliar accents or speech intonation.

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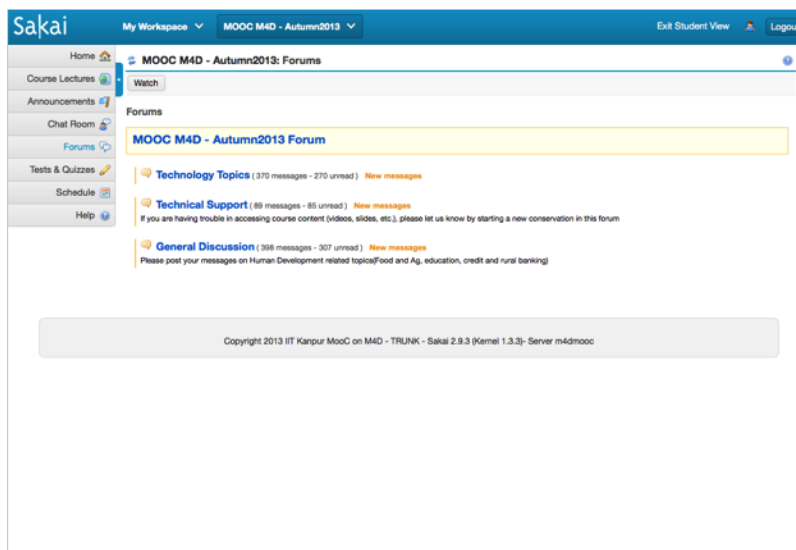
M4D Course Activities

There were two activity strategies employed during the course:

- Chat room
 - 1,641 messages were exchanged in the Chat Room during the course



- Discussion forums
 - General discussion forum with 398 messages across 76 topics
 - Technical forum with 370 messages across 55 topics
 - Technical support forum with 89 messages across 35 topics



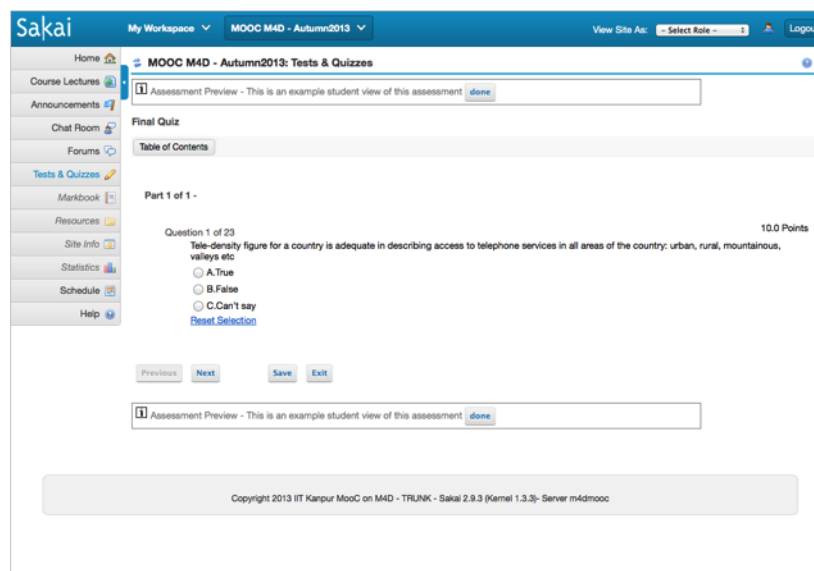
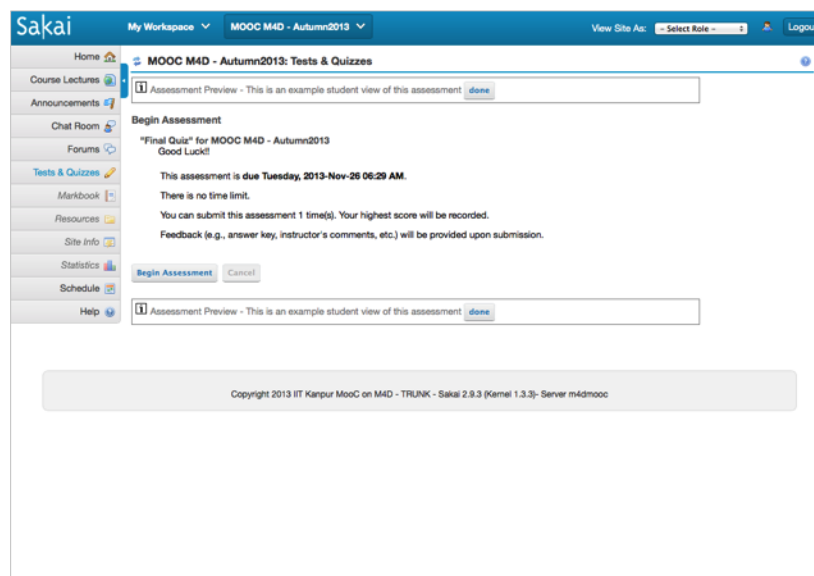
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Evaluation strategies

Online quizzes were employed as an evaluation strategy. There were three quizzes during the course:

- Test Quiz 324 students submitted quizzes for evaluation
- Quiz 1 296 students submitted quizzes for evaluation
- Final Quiz 261 students submitted quizzes for evaluation

The quiz format used multiple-choice questions as illustrated in the screen captures below from the Final Quiz of the M4D course.



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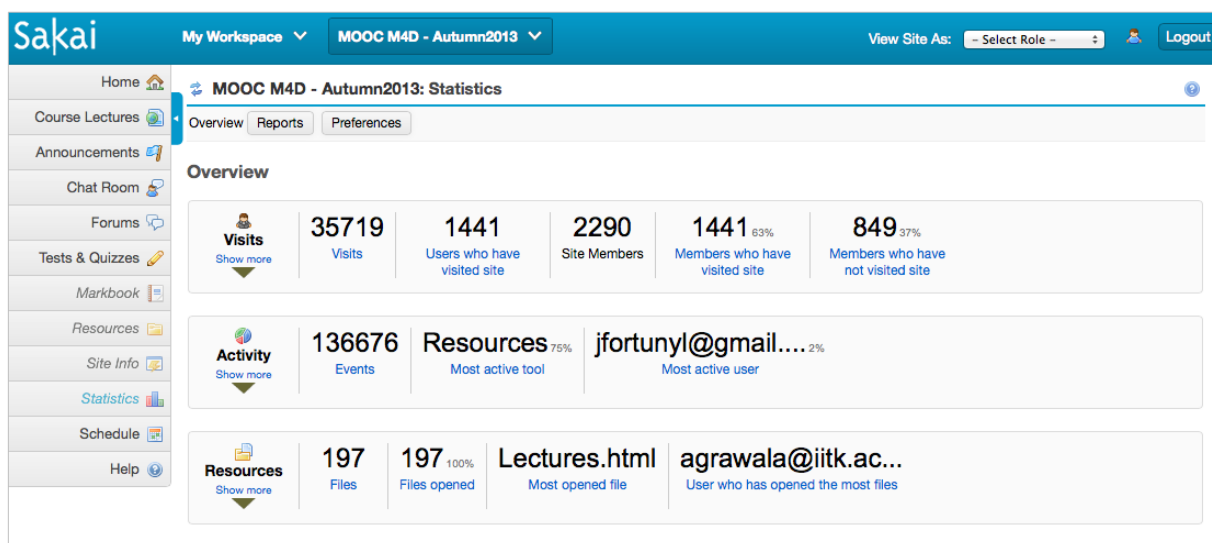
COURSE RESULTS

The course began with 2,282 course registrants, from which 1,441 registrants were considered active participants in the course during its six-week timeframe. Site statistics from the M4D course site provide a snapshot of activity and participation.

Students

Although no detailed individual demographics are yet available for the course participants, the following summary data provides a high-level snapshot of course participants and their participation level:

- The course attracted 2,282 registrants from 116 countries.
- About 63 percent of the registrants (1,441) were active in the course space.
- A total of 333 participants were found eligible for receiving certificates of Competence (244 participants) or Participation (89). Certificates were awarded to approximately 23% of active participants in the M4D course.
- The top five countries in terms of registrants were India, Nepal, Mauritius, Grenada and South Africa.
- About 500 registrants were from countries in the Africa-Caribbean-Pacific regions. About 200 registrants were from the OECD countries and from East Europe.



For the participants who participated in the M4D course quizzes, two kinds of certificates were awarded.

If a participant performed well in the quizzes, the instructional team awarded her/him a "C" (Competency) certificate. For those students that did not do as well in quizzes, but had participated in the course to a reasonably consistent level, the team awarded a "P" (Participation) certificate. An M4D course participant was awarded only one type of certificate.

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Precise criteria for both of the "C" and "P" certificates is described below:

- If a student's aggregate score from all quizzes was more than 40%, then the student was awarded a "C" certificate. For example, assuming both quizzes to be of 100 marks and the student scored 20 marks in quiz-1 and 70 in quiz-2 then the combined score ($20 + 70 = 90$) is more than 40% ($0.4 \times 2 \times 100 = 80$), hence she/he would be awarded a "C" certificate. 264 "C" certificates were awarded.
- If the student did not qualify for a "C" certificate, but her/his aggregate score from "attendance" and quizzes was more than 50%, then the student was awarded a "P" certificate. The instructors calculated the "attendance" score by statistics for Core Lecture videos/slides (PDF). For example, if a student's score on "attendance" was 45% and her/his score on all quizzes was 5% then the student was awarded a "P" certificate. 89 "P" certificates were awarded.

Based on these criteria, certificates were prepared. Each certificate, "C" or "P" was jointly signed by the Center for Continuing Education, IIT Kanpur and the Commonwealth of Learning. Certificates were awarded to 333 students, approximately 23% of active participants in the M4D course.

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COURSE TECHNICAL PLATFORM

Background to the technical platform selection

While the M4D course team was planning the M4D course, it tested the software platform *Canvas*, as a hosted service from *Instructure* (the vendor), to determine its feasibility as a technical system for course delivery. Cost estimates provided by *Instructure* for the hosted service were as follows:

- The quoted cost for 400 learners was USD \$10,000 for six weeks
- Additional students up to 1000 (that is, an additional 600) were to cost \$3.28 per “seat” for this period
- The total cost estimate for 1600 students was: $\$10,000 + (600 \times \$3.28) = \$11,968$.
- There was no clarity on numbers beyond 1000 additional students

The vendor offered the following standard client services as a part of the proposed contract package:

- Authentication integration assistance for supported identity providers, including LDAP, CAS or SAML 2.0
- Standard Online Training Package that included administration, user support, and instructor training webinars
- Site branding assistance with colour header for website with a logo for the institution
- Basic student information system (SIS) endpoint, with a bulk enrollment API enabled that accepted updates provided in the *Canvas* SIS import format
- Test/training instance: refreshed every three weeks (to coincide with the *Canvas* release schedule) with production data for the duration of the account
- Premium support package (details unspecified)
- The vendor indicated that the implementation process would take 90 days from contract signing to execution of a live M4D course site

Because the *Instructure* proposal appeared too costly, the team proceeded to use the complied open-source “community edition” software code for *Canvas*, available from GitHub, and installed the code on the *Amazon* cloud service. However, it became quickly evident to the development team that open source edition of the *Canvas* code presented serious stability issues that would be unacceptable as an implementation platform for the M4D course.

The choice of *Sakai* as the technical platform for M4D

As a consequence of the testing of *Canvas*, the team decided immediately, and one week prior to M4D registration opening, to switch to the open source *Sakai* platform. The team at IITK wrote a custom set of software code in a short timeframe in order to make *Sakai* compatible with the registration interface previously built on the Drupal platform.

Sakai was chosen as the course technical platform because it was available as open source software and had a reputation for scalability with large numbers of students. This proved to be the case in the M4D course.

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The IITK team identified *Sakai*, an open source platform, as most suitable for use as an online classroom in this course. It was also mobile-enabled so that some of the interested learners could access it from tablets or smartphones.

An external review of the *Sakai* software describes some of the technical platform's key features, many of which were used in the M4D course (University of Virginia, 2014):

“The *Sakai* software includes many of the features common to course management systems, including document distribution, a grade-book, discussions, live chat, assignment uploads, and online testing, but the capacity for online collaboration is really the tail that wags the dog here. *Sakai* is intended as a collaborative tool for research and group projects. To support this function, *Sakai* includes the ability to change the settings of all the tools based on roles, changing what the system permits different users to do with each tool. It also includes a wiki, mailing list distribution and archiving, and an RSS reader.

If online student collaboration, within classes or not, is a major part of what you will be doing I strongly recommend trying *Sakai*. Trying *Sakai* is low risk because it is free and you generally can demo it at www.SakaiProject.org without having to install it. You can download the software to install at that same URL. “

The *Sakai* technical platform is highly capable and scalable and proved to be a stable technical platform on which to mount and conduct the M4D course with approximately 1,400 students.

However, it is a plain and simple learning system in its raw form and could use graphic design support to effectively brand it, and increase its eye appeal for learners. The additional of graphic design elements, institutional colour schemes and logos could require additional cost by the development team in future.

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COURSE COST ANALYSIS

One possible framework for cost analysis

Bates (2001) provides a sample schema for analyzing costs for an online course or program development process that includes the following elements that require cost analysis.

- Planning
 - Including time and effort costs required for meetings and development discussions
- Program administration and overheads
 - Including time and effort costs required to use institutional systems and processes for the development, delivery, assessment, and certification of the course
- Development
 - Including time and effort costs for faculty to develop content, media to be produced and mounted on the online course delivery system
 - Including time and effort costs for custom software development
- Maintenance
 - Assuming the course will be maintained and delivered again to help amortize overall development costs
- Delivery
 - Including license, time, and effort costs associated with the operation of the technical platform on which the course was delivered

Intangibles and variables in the model include the calculation of faculty costs in the development and delivery process. However, 'targets' are often set for faculty workload and are included in their tenure costs. In the Bates model the aim was to make sure the teaching load for a fully online course was no more than that of a face-to-face course for a tenured professor. The target was also influenced by experience from earlier online courses concerning the faculty time needed for these kinds of courses.

COL cost analysis

From documents provided to COL by IIT Kanpur the following conclusions were drawn:

- COL provided a total of C\$15,000, which was converted into Indian Rupees.
- The bulk of the course costs (just over 75%) were incurred in content development, including costs of recording and editing of instructional videos.
- The IITK team provided support for server management costs, which was actually a substantial contribution although they, as a public institution, had not placed a monetary value on IT support

In terms of COL's contribution, the Director, Technology & Knowledge Management contributed about five percent of his time of his time to the project and COL hosted the home page of the course, <http://m4d.colfinder.org> on its server at an annual hosting cost of USD \$120.

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Other IIT Kanpur costs

The IITK team had full administrative privileges on the <http://m4d.colfinder.org> server and the IITK team added to this a secure and reliable registration system from which they transferred data in a secure way to the online class site, www.m4d-mooc.org.

The transfer process was developed exclusively for this course by IITK, since it involved transfer from Drupal to *Sakai* for which there are no known solutions.

This software development process has not been assigned a cost by IITK.

Reviewer comments

A clear need for future iterations of the M4D course and similar courses that may be considered for development by COL and IIT Kanpur, is the need to use a consistent cost-analysis framework that would account for all costs.

Based on the available data for the M4D course, the investment of C \$15,000 and the USD \$120 hosting costs for the <http://m4d.colfinder.org> server were the only tangible costs that could be provided for this review.

Bates (2011) noted that faculty time and effort required for development of materials and instruction tend to be the major costs required for online course delivery. Therefore the total costs for development and delivery of the M4D course could be estimated by assigning an hourly rate to the efforts of faculty, media staff and technical staff. Using this method and an estimate of hours invested by each would provide an approximation of the total cost for development and delivery of the M4D course. These costs could be estimated retrospectively to produce a benchmark metric for future development.

The literature on MOOC development provides estimates of course development and delivery costs between USD \$50,000 and \$250,000 for a single instance of a large-scale MOOC. These cost estimates suggest that even with limited cost data available that the M4D course would likely be at the low end of the cost scale for development and delivery.

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FEEDBACK FROM STUDENTS

An online student survey was conducted with students after the course was completed. A total of 208 responses to survey questions were received from students. For each question students were provided with a five-point scale with which to provide a numeric answer, with 1 being the lowest rating and 5 being highest rating. The questions, the student ratings, and averages for numeric ratings are provided in the tables below.

Overall student satisfaction based on response to questions with numeric responses was 87 percent, indicating strong satisfaction for the instructors, course content, resources, and delivery format.

STUDENT SURVEY RESPONSES TO QUESTIONS REQUIRING A NUMERIC RATING

QUESTIONS	NUMBER OF RESPONSES	AVERAGE RATING
The website was easy to use.	208	4.38
How would you rate the usefulness of discussions on forums/chat sessions?	207	4.06
Questions in the quizzes were relevant and well chosen.	205	4.12
How was the clarity of instructor's presentation of the material (slides, audibility, vocal clarity)?	205	4.30
The short course was delivered consistent with its stated objectives.	207	4.40
Overall I am satisfied with the quality of this short course.	208	4.45
The presenter had good knowledge of the subject content.	206	4.66

The student survey asked two questions requiring YES, NO, CAN'T SAY responses. The questions and responses are detailed in the table below. 71 percent of students indicated they would have taken the M4D course even without certification. 97 percent stated they would recommend the M4D course to others.

STUDENT SURVEY RESPONSES TO QUESTIONS REQUIRING A YES, NO, CAN'T SAY RESPONSE

QUESTIONS	YES	NO	CAN'T SAY
Would you have taken this course if there were no certificate offered?	147	31	29
Will you recommend this course to others?	201		7

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In addition to questions requesting numeric ratings and Yes/No responses, students were provided four open-ended questions that requested a text-based response. The text-based responses from 208 students were coded and clustered as themes by the reviewer, using qualitative analysis software. The questions and the emergent themes from student text-based responses are detailed in the tables that follow.

The top five emergent themes from the coded and clustered responses are listed for three of the questions. For the fourth question, asking for interest in other course topics, an expanded list of themes is provided.

STUDENT SURVEY RESPONSES TO QUESTIONS REQUIRING A TEXT-BASED RESPONSE

QUESTION	EMERGENT THEMES FROM RESPONSES
What did you particularly like about this short course?	<ul style="list-style-type: none">• Course content, and especially its practicality• Course format and especially its use of videos with scripts, slides, case studies and online quizzes• Relevance of the topics and case studies to the developing world, agriculture and banking• Professional knowledge of the instructors, their preparation, and the quality of explanations of the course topics• Convenience of the online course format and the flexibility of the design to accommodate students' working lives
What suggestions do you have on how we can improve this short course; in its content, delivery or administration?	<ul style="list-style-type: none">• Video: Shorter and higher quality video and audio sequences of between 8-12 minutes. The ability to more easily download the video segments and case studies for offline viewing. More uniform audio quality throughout – some were of lower quality.• Practicality: More use of applied topics, mention and use of mobile applications, and practical examples and demonstrations were requested by some students who found the topics too technical for non-technical participants• Assessment: More quizzes, perhaps on a weekly basis at the end of topic segments. The ability to re-do quizzes to achieve mastery. More variety in the style of online quizzes• Discussion summaries and topic summaries provided on a weekly basis• Hands-on, live or practice exercises that required students to practice their learning

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What did you NOT like about this course?	<ul style="list-style-type: none">• Length of videos presented access problems for live viewing in areas with Internet connectivity issues. Consider download or pre-packaged videos on CDs or DVDs as alternative formats• Too technology focused, with a need for more practical examples and case studies• Intensity of the course and heavy video content load made it difficult for late starters to catch up, or working students to catch up if they fell behind• Quizzes had too many technical questions for non-technical participants
What other short courses would you be interested in for the future?	<ul style="list-style-type: none">• Educational topics: instructional design, applications of mobile technologies for teaching and for use in libraries• Agricultural topics: GPS, GIS, meteorology, fuzzy logic, mobile use in agriculture with expanded cases studies from other areas of the world• Wireless and network topics: mobile application development especially for Android devices, cloud computing, web analytics• Security: cyber-security, ethical hacking• Management: knowledge management, management skills, technology transfer• Research: research methods, research methods employing mobile technologies• Digital media: web development, media production, HTML5, media storage preservation• Entrepreneurship: small business development, small business development in rural settings• Health: applications of mobile technology for health and safety applications• Finance: banking, alternative banking systems, micro-finance, organization and management of cooperatives• Gender: gender equity, gender issues

The open-ended responses indicated strong support for the M4D course. The responses also provided an opportunity for students to highlight areas for improvement in subsequent iterations of the course. The feedback was both positive and constructive, and should be incorporated into future course designs.

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FEEDBACK FROM THE DEVELOPMENT TEAM

An online questionnaire was provided to seven members of the M4D MOOC development team members in March 2014, four months after the conclusion of the course. The questionnaire asked team members to consider the course from a design perspective, and in particular from their roles as team members.

Five team members provided responses to nine questions that included eight open-ended text-based response questions, and one question that required a checklist response. The responses are provided in the sections that follow, along with some discussion of the responses from the reviewer's perspective.

QUESTION 1

QUESTION	DEVELOPMENT TEAM RESPONSES
What was your role in the M4D MOOC course design, development or delivery processes?	<ul style="list-style-type: none">• 1. Instructor (course design and content creation) 2. Technology expert for MOOC platform• Played a role in all parts - conceptualise, design, develop and delivery• Instructor• I helped in the development of the course by creating 8 videos that were used in the course. I was also a moderator for a synchronous session and I participated in the asynchronous forums.• I was mainly responsible for setting up and managing the technical platform, content release process and delivering technical lectures on Android, Mobile OS and App Development.

Reviewer comments:

Each of the participants who responded indicated a clear understanding of her/his role within the M4D course team.

Experienced educators with a background in open and distance learning (ODL) might be expected to understand the differentiated staffing models typical of ODL institutions and programs. In the case of the M4D course, the experience of the individual team members was revealed through the clarity with which each of those professionals specified her/his role within the team in the questionnaire responses. They knew their roles and executed them within the M4D course framework.

As a general recommendation, the selection of participants for MOOC design, development or delivery processes would benefit from having individuals with significant ODL experience as a part of the team. MOOCs are complex educational projects requiring defined instructional development and delivery skill sets.

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QUESTION 2

QUESTION	DEVELOPMENT TEAM RESPONSES
What were your personal goals associated with participation in the design, development and/or delivery of the M4D MOOC? That is, what did you hope or expect to achieve through your participation in M4D?	<ul style="list-style-type: none">• Wanted to share my knowledge in the domain and learn about how to 'run a MOOC' - end to end. Also wanted to explore platforms for delivering a MOOC.• Share my knowledge of mobile learning and participate in an m-learning dialogue; guide students; support the m-learning community• (These points are not in any particular order.) 1. Knowledge dissemination. 2. Gain more experience with new delivery model (i.e. MOOC) for knowledge dissemination. 3. Showcase and attain greater visibility for our capabilities for end-to-end design and operation of MOOCs. 4. Generating new knowledge/ideas via online discussions that happened over this MOOC's forums. 5. Validate our costing models for end-to-end design and operation of the MOOCs of this nature.• I believe that learning materials should be available and made affordable to people in developing countries. This was my personal goal in getting involved in the MOOC course. I am also interested in MOOC research and this project gave me ideas on research areas that are needed.• I was interested in broadening my knowledge in the space of M4D by learning from other instructors and students. I was also interested in gaining practical experience of managing a MOOC platform, understanding issues in running a MOOC like generating good quality content, etc.

Reviewer comments:

The statements of participants about their personal goals for M4D were highly congruent with stated aims and objectives of the course, and the partnership between ITT Kanpur and COL

Not only did team members express a strong desire to provide accessible learning at low cost, they also expressed a willingness to both learn and share knowledge, and to become co-learners with students and other instructors. In particular, team members expressed a desire to learn more about MOOCs as a delivery format and as a pedagogical practice, and through the course contribute new knowledge.

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QUESTION 3

QUESTION	DEVELOPMENT TEAM RESPONSES
<p>Which teaching or pedagogical strategies do you believe were supported within the M4D MOOC (for example: information transmission, experiential learning, inquiry-based learning, collaborative learning, knowledge management)?</p> <p>Comment on any that you feel should be added or elaborated.</p>	<ul style="list-style-type: none">• Major pedagogical strategies supported by M4D in that order: 1. Information transmission 2. Inquiry-based learning 3. Collaborative learning• Information transmission - is the major one. Experiential learning and inquiry-based learning were handled through homework (not graded - hence not known if the student has done them).• Information transmission, collaborative learning, knowledge co-creation through dialogue• There was information transmission in the asynchronous session where participants were able to view videos, access the PowerPoint presentations, and read the transcripts of the videos. This MOOC was flexible since participants who were not able to watch the videos because of low connectivity, were able to download the PowerPoint slides and the video transcripts to read at a later time offline. The MOOC allow for participants to connect with each other using forums. The forums were very active. In addition to posing questions, participants provided information on their own experience with mobile for development. One suggestion is that there should be sub-forums where groups work together on problems and projects and share with other participants. There could be more problem-based activities.• I believe that M4D MOOC supported many teaching strategies like learning material from field experts (video lectures/slides) were following information transmission strategy. Participation in forums and chat rooms provided collaborative learning among students. A very good quality of content has been generated in forums and chat rooms.

Reviewer comments:

Team members' responses indicated that the primary strategy was information transmission in the design of the M4D course. Collaborative discussions contributed to knowledge building and better understanding.

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QUESTION 4

QUESTION

Please comment on the instructional design or technology support that was available to you as a developer or instructor for the M4D MOOC, and whether the support met your pedagogical objectives for the course and its students?

Reviewer comments:

Most of the team comments dealt with the technical aspects of instructional resource production. In some cases team members had knowledge or skills that enabled them to produce their own resources. In other cases specialized support was provided, particularly for video production.

One role that was not discussed explicitly in comments was instructional design support for the primary structure of the learning outcomes, resources, activities and assessment strategies within the M4D course. This is an area of practice that also requires specialized support from professionals.

DEVELOPMENT TEAM RESPONSES

- Instructional design: It was mainly from my own experience; I did not look for any specific support in this area. However, I reviewed my lecture briefly with co-instructors to get their feedback for any glaring issues or improvements. Technology support: I myself was one of the technology support persons (There were others as well) for M4D MOOC. Tech support included: 1. Managing content on the LMS platform that we used. 2. Monitoring the web server for security and other issues (usual stuff associated with any public facing web application). 3. Editing raw lecture videos. I believe that both instructors and students were satisfied with the generation and delivery of content (whether generated by instructors as video lectures, or by students via online discussions).
- For creating content, we used a mash-up of tools readily available in the Institute - like recording studio, Adobe video editing, MS PowerPoint, IHMC Cmap tools. Do wish we had professional level video editing and animation support was available.
- Instructional design support provided during the video creation process was crucial to the success of my contribution to the MOOC; well-designed professionally looking multimedia materials are a vital element of any online course.
- The video production facilities at COL allowed me to develop the videos. The LMS worked well for the course. For MOOC in developing countries it is important to have simple LMS that allow people with low connectivity to access the learning materials. The LMS was appropriate for this.
- We used *Sakai*, which is an open source MOOC platform. From functionality point of view, it had most of the features available to us. However, a lot of effort has been spent in customizing these features according to our needs. For course registration process, we developed a new Drupal based application.

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QUESTION 5

QUESTION

Please comment on the attributes of the technical platform used to deliver the M4D MOOC and in particular its ability to support your pedagogical objectives for students?

DEVELOPMENT TEAM RESPONSES

- Primarily we wanted to have two pedagogical threads: 1. For dissemination of content 2. For allowing collaboration amongst participants. Second one -- collaboration -- inherently allowed for inquiry based learning. Technology platform that we chose supported the above two threads (it had online discussion forums and chat rooms, and also well sequenced video lectures). Other area where choice of technology platform was important was content creation. Chosen tools allowed us to record/edit video lectures in a flexible manner.
- Used *Sakai*, hosted on Amazon. It is not a sophisticated platform like *edX*, but it suited quite well since our audience were not challenged by the platform. The chat room could have been better, though.
- The selected platform offered an environment conducive to online learning through resource and expertise sharing. Materials were well organized and linked to the relevant discussion and private space in the platform. There were tools for synchronous and asynchronous interaction supporting knowledge co-creation. The platform was rather easy to navigate and a variety of tools were available to enable a more personalized learning experience. Students could easily contact other learners as well as instructors.
- The platform allowed for the presentation of the information and for forum participation. It was simple for the novice to use. In this course, there was technical help for those with access problems.
- The *Sakai* platform was robust and customizable. We had very few minor technical issues during the course. It had all features to handle our pedagogical objectives.

Reviewer comments:

As indicated by team responses, the *Sakai* platform worked well for the design and delivery of the M4D course and supported the two primary design needs for dissemination of content and support of discussions. Some refinements to chat spaces and discussion forums may be needed in future courses.

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QUESTION 6

QUESTION

Please comment about how well you believe the M4D MOOC design supported the desired learning outcomes that the course was intended to deliver.

Reviewer comments:

Team members took the opportunity in this question to comment about the success of the M4D course in achieving its desired learning outcomes, and to offer thoughts on how the M4D design might be improved.

Improvement strategies suggested included:

- Peer groups or TAs to support learners
- More quizzes after each lecture
- Lecture-based discussion threads
- Personalization tactics
- Activities to help develop skills
- Opportunities for local sub-groups, support groups and access to locale experts

The recommendations for improvement cited by team members in Question 6 should be used as a set of design features for consideration and testing in future iterations of the M4D course.

DEVELOPMENT TEAM RESPONSES

- Course participants, expectedly, had large variation in background and course access environment. Despite this diversity, the online discussions/chats that happened on M4D showed that the intended learning outcomes were achieved to a great extent.
- Correcting the homework (either through peer groups or through TAs) would have helped greatly. More quizzes, especially in the middle or immediately after each lecture would be good. Lecture based discussion threads (even though this was attempted, platform support was not available) would have helped.
- As mentioned above the MOOC design was effective; however, additional strategies to guide participants to the discussions and materials that were of particular interest to them would be desirable. For instance, forming sub-groups or discussion forums focusing on a particular issue/topic as opposed to having all discussions in one overwhelmingly large forum. Any strategies to provide more guidance towards resources/discussions on particular interests of learners, as well as personalizing the experience - making participants feel that they are individual student as opposed one of a few thousands of students.
- The learning outcomes of the course were more of an awareness of M4D and information on how to use M4D and case studies around the world. Hence, the design supported the learning outcomes. If the learning outcomes were to develop skills in M4D then more depth should be covered and the participants should be given activities to develop the skills. To develop the skills, a blended approach will be good where participants learn the information in the MOOC and they work with local experts to develop the hands on skills.

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-
- The course was designed to teach technical concepts through real life examples and case studies. By looking at the participation in forums and chat rooms, I believe that the course did a great job in empowering participants (with little or no technical background) to use mobile technologies in development issues.
-

QUESTION 7

QUESTION

Please comment on what you believe might be desirable attributes that students should possess to be successful in a course such as the M4D MOOC.

DEVELOPMENT TEAM RESPONSES

- 1. Should be comfortable and enthusiastic about online engagement. 2. Should have access to the Internet.
- Engagement. Wanting to learn rather than a certificate (we had a few like that)
- Commitment to participation and completion of the entire course or all the elements of the course that are relevant to them, which might be achieved by customizing the learning path for individuals in the course.
- Students should have the following attributes: (1) good communications skills (2) good ethics not to offend anyone (3) basic computer skills (4) flexibility in time to access the course materials and to participate in synchronous sessions because of different time zones (5) good time management skills (6) be able to read and understand the language the language the MOOC is delivered in.
- To be successful in a course like M4D MOOC, students should regularly cover the course material and actively participate in the course activities. Apart from learning content, the course provided a platform to students for discussion on development issues with the field experts as well as other students.

Reviewer comments:

Desirable attributes for students in a course such M4D included skills that might be used to describe independent learners or distance learners. Each team members described somewhat different attributes.

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QUESTION 8

QUESTION

Please identify the key features of the M4D MOOC, from your perspective. Using labels from the M•O•O•C illustration below as a guide, please make your choices from the checklist in Question 9, below.

DEVELOPMENT TEAM RESPONSES

- No responses were required in Question 9. Questionnaire participants were asked to review the illustration in preparation for a self-assessment of the M4D MOOC's attributes in relation to the illustration provided as an organizer for design attributes associated with MOOCs.

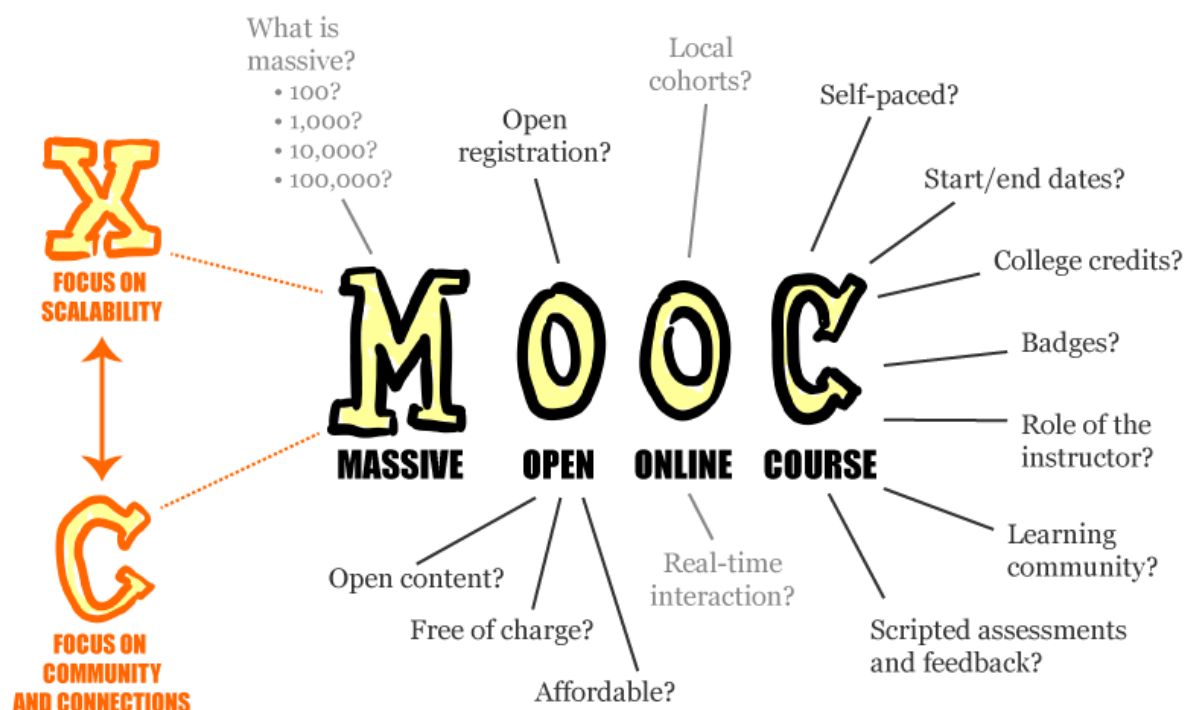


Image by Mathieu Plourde (2013).



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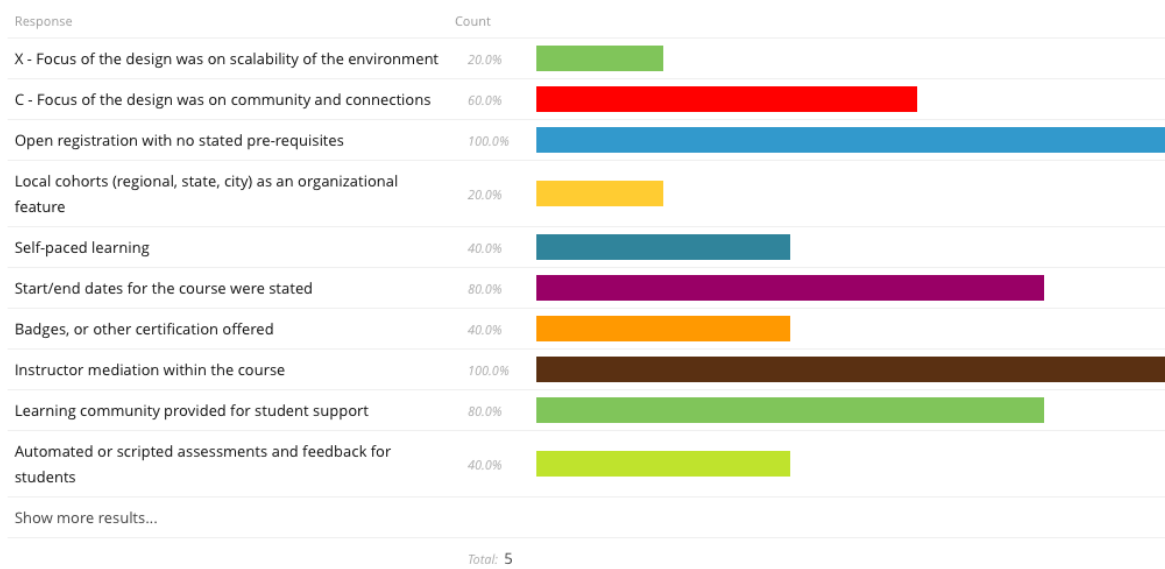
QUESTION 9

QUESTION

Use the checklist to select what you believe to be features of the M4D MOOC, using the diagram in Question 8 above as a reference.

DEVELOPMENT TEAM RESPONSES

- The graph below describes the scale of response on each checklist item.



Reviewer comments:

The responses by the M4D development team are indicative of the hybrid MOOC environment that was created for the course. Although M4D registered over 2,000 students, of which over 1,400 were active learners in the course, the design intent of a majority of the team was to create community and connections as a part of the learning experience for students. In this sense, the M4D more closely resembles *edX* style MOOC courses than it does either the large-scale xMOOCs, or connectivist cMOOCs, where the curriculum is formed through student-instructor interactions with significant exploratory, social and experiential components. M4D sits midway along a continuum that has xMOOCs on one end and cMOOCs at the opposite end.

Other comments from the development team questionnaires concerning recommendations for local support groups, segmented and structured discussion forums, and additional experiential and hands-on activities for students, hint at a desire to design a MOOC environment that moves closer to a cMOOC format.

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QUESTION 10

QUESTION	DEVELOPMENT TEAM RESPONSES
Please provide additional comments about the design intent or design features of the M4D MOOC that were not addressed in the previous questions.	<ul style="list-style-type: none">• None.• We send the course material to some of the students, on a CD. The course was about Technology for the non-technologist. It was about 'solution architecture' -- a design of the solution by the Domain expert with 'architectural level knowledge' of the technology (for example, missed calls and how to use them in a solution).• Having participated in a number of MOOCs, I believe that it would be beneficial to learners to provide them with a more personalized experience offering expert support in terms of guidance through the course materials and activities as well as the subject matter expertise. The role of the instructor and other learning supports remains vital which results in certain limitations in terms of the cost and start/end dates of the course.• For the first implementation of this MOOC, the design and delivery were excellent. For future delivery the following are suggested. (1) Have weekly forums (2) Get people in local areas to meet each other for collaboration (3) summarize the forums so participants get a sense of completion (4) provide high level discussion questions for critical thinking.

Reviewer comments:

Responses to the final question about design intent and design features reiterated some of the recommendations that have been noted in previous responses including:

- Use of alternative resource delivery formats for student in situations where Internet connections and bandwidth issues were an impediment to participation in the course (i.e. CDs and DVDs)
- Personalization of the learning experience to better meet the needs of students
- Structured, weekly discussions forums
- Engage students in higher-order critical thinking through discussion strategies
- Discussion and/or topic summaries on a weekly basis

Summary and Recommendations

M4D WAS AN INNOVATIVE ONLINE COURSE

Bates (2014) cited a video presentation by Dr. Rory McGreal, Contact North | Contact Nord Research Associate and the UNESCO/Commonwealth of Learning Chair in Open Educational Resources, in which McGreal suggested some steps that can help faculty and instructors to approach the issue of innovative online teaching in a systematic way, including:

- Being clear on the problem you are trying to solve
- Working in a team
- Applying technology appropriately to address the problem to be solved
- Evaluating and disseminating your innovation
- Providing greater flexibility for students as a new mantra

It is clear from the review of the M4D course that its instructional team had intuitively followed the steps outlined by McGreal. A primary goal for the M4D course was to determine how best to use MOOCs to serve the development needs of resource-poor communities of learners — those at the "bottom of the pyramid" (Pralhad & Hart, 2002). Course outcomes and feedback from students indicated that an M4D goal was achieved, and that students were constructive with their feedback and suggestions for improvement.

The team also conducted the M4D course with a view to better understanding the dynamics surrounding the design, delivery and support issues in delivering MOOC-style courses. Their aim was to develop solutions and action plans that would support the primary goals for the course and lead to improvements in practice in subsequent iterations of the M4D.

It is in the spirit of the M4D team's general goals that the following recommendations are offered.

RECOMMENDATIONS

Recommendation 1

Adopt an iterative, design-based research (DBR) approach for all MOOC-style courses developed jointly between IIT Kanpur and COL. DBR (Wang & Hannafin, 2005, p. 6) is "a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually sensitive design principles and theories."

A DBR approach would embed a research process into the course development and delivery processes that could be replicated over multiple iterations of the course. Using both quantitative and qualitative research strategies, the team could add design features, improve the learning resources, improve the delivery model and assessment strategies, and evaluate the overall effectiveness of the re-designed course to meet the stated learning outcomes.

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The resulting design principles could become a model for development and delivery of large-scale courses to support development education outcomes.

Recommendation 2

Plan, re-design, and implement additional iterations of the M4D course, incorporating improvements suggested by students and development team members. Use an iterative DBR strategy as the guiding schema for course design and evaluation, and set specific goals for the course re-design and updated delivery processes. Evaluate and report the findings with a view to optimizing the course and defining a generalized set of design principles for courses of this type and intended audience.

Recommendation 3

Consider the primary outcomes for the course in the re-design process and whether the aim of the course is knowledge transmission (what students will know), competence (what students should be able to do), or a broader goal such as learner empowerment (the ability to learn on one's own from multiple sources). Be explicit about designing for the primary outcome/s (Guardia, Maina & Sangra, 2013).

Recommendation 4

Use additional quizzes at the conclusion of each topic or week of lessons in M4D. The quizzes would provide ongoing feedback for students and potentially offer an incentive for them to continue their participation towards a certificate.

Recommendation 5

Re-organize online chat spaces and online discussion forums into moderated and structured activities associated with course topics or emergent topics. The discussion should be managed and curated by a designated online moderator who would also post discussion summaries on a weekly basis. Teacher presence in online spaces is a powerful design feature (Anderson, 2008).

Recommendation 6

Consider a course pre-test and post-test for students to help gauge the relative achievement of students entering the course with different levels of knowledge, measured against their acquired knowledge.

Recommendation 7

Use a cost-analysis framework to monitor course development, delivery and evaluation costs. Using a consistent schema, such as the one outlined by Bates (2001) to measure and control costs, would provide a benchmark for further planning and development.

Recommendation 8

Consider a credential pathway for M4D, with a view to formally associating the course for credit with institutions that are members of the OER Universitas Consortium (<http://oeruniversitas.org>). A credential is a powerful incentive for participation, and aligns with the M4D goals for students seeking to advance their standing or careers in the developing world.

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